

Claims

1. A control system for controlling apparatus remotely in response to changes of a variable, characterised in that said control system comprises
5 a sensor module to sense the variable, a controller module operatively associated with the sensor module and including a radio transceiver operative to transmit a control signal when the variable changes and to transmit and receive system management signals, and a responder module arranged remote from the controller module and including a radio transceiver
10 operative to receive the control signal and to receive and transmit system management signals.

2. A control system as claimed in claim 1 characterised in that said sensor module senses the presence or absence of users of the controlled apparatus.

15 3. A control system as claimed in claim 2 characterised in that the controlled apparatus comprises electrical lighting which is turned on when persons are present and turned off when persons are absent

4. A control system as claimed in any preceding claim characterised in that said variable comprises an output from an intruder alarm for premises
20 containing the controlled apparatus.

5. A control system as claimed in any preceding claim characterised in that the sensor module senses electrical mains power and the controlled apparatus comprises emergency lighting arranged to be turned on if the

electrical mains power fails.

6. A control system as claimed in claim 1 characterised in that said variable is a natural variable.

5 7. A control system as claimed in claim 6 characterised in that said apparatus comprises heating apparatus or cooling apparatus and the natural variable is ambient temperature.

8. A control system as claimed in claim 6 characterised in that said apparatus comprises electrical lighting apparatus and the natural variable is ambient light level.

10 9. A control system as claimed in claim 8 characterised in that the electrical lighting apparatus comprises a fluorescent unit including a dimmable ballast operatively associated with the responder module and adjustable thereby.

15 10. A control system as claimed in claim 9 characterised in that adjustment of the dimmable ballast by the responder module is such that the perceived output of the fluorescent unit varies substantially linearly.

11. A control system as claimed in any preceding claim characterised in that the responder module comprises a repeater for said signals.

20 12. A control system as claimed in any preceding claim

characterised in that the radio transceiver of the controller module is of the same form as the radio transceiver of the responder module.

5 **13.** A control system as claimed in any preceding claim for controlling apparatus comprising a plurality of units characterised in that the system comprises a plurality of said sensor modules respectively responsive to a plurality of said variables and a plurality of responder modules respectively associated with said units.

10 **14.** A control system as claimed in any preceding claim characterised in that at least some of said sensor modules sense mutually different variables.

15. A control system as claimed in claim **13** or claim **14** characterised in that the controller module is operative to transmit a plurality of control signals respectively corresponding to sensed changes of said variables.

15 **16.** A control system as claimed in any of claims **13** to **15** characterised in that the system management signals include identity signals individual to the responder modules.

17. A control system as claimed in any of claims **13** to **16** characterised in that the system management signals include identity signals individual to a set of responder modules arranged in a group or a zone, which set can be switched on and off together.

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18. A control system as claimed in claim **16** or claim **17** characterised in that the identity signals each comprise four hexadecimal digits.

19. A control system as claimed in any of claims **13** to **18**
5 characterised in that said controller module includes a status array recording the proper status of the responder modules.

20. A control system as claimed in claim **19** characterised in that the controller module includes reset means operative to check the actual status of each responder module against the recorded status and to indicate
10 any discrepancy.

21 . A control system as claimed in claim **19** or claim **20** characterised in that the controller module is operative to switch units of the controlled apparatus on and off alternatively by transmitting a global switch control signal associated with the identity signals of the corresponding
15 responder modules followed by status request signals to those responder modules seriatim.

22. A control system as claimed in claim **21** characterised in that each responder module is arranged to respond to its status request signal by transmitting an actual status signal for receipt by the controller module and
20 comparison with the record in the status array.

23. A control system as claimed in claim **22** characterised in that, if for any responder module there is a discrepancy between the actual status

and the record, the controller module transmits a correction signal to change the status of that responder module to its proper status.

5 **24.** A control system as claimed in claim **23** characterised in that on receipt of the correction signal the responder module transmits a confirmation signal to the controller module.

25. A control system as claimed in claim **24** characterised in that the responder module concerned is recorded as faulty if no confirmation signal is received by the controller module.

10 **26.** A control system as claimed in any of claims **19** to **25** characterised in that said system includes a computer and an interface whereby control and/or management information of the system is delivered to and/or from the computer.

27. A control system as claimed in claim **26** characterised in that the interface utilises a command language suitable for a PC.

15 **28.** A control system as claimed in claim **26** or claim **27** characterised in that the computer is operable to supply control and/or management information.

29. A control system as claimed in claim **28** characterised in that the computer includes a graphical user interface whereby said control and/or management information is supplied.

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30. A control system as claimed in any of claims **26** to **29** characterised in that said system has a schedule under which the control varies with time.

31. A control system as claimed in claim **30** characterised in that
5 said system includes a calendar.

32. A control system as claimed in claim **30** or claim **31** characterised in that said system includes a timer.

33. A control system as claimed in any of claims **30** to **32** characterised in that the computer is programmable with said schedule.

34. A control system as claimed in any of claims **26** to **33**
10 characterised in that the computer is programmable to partition the system into groups and/or zones.

35. A control system as claimed in any of claims **26** to **34** characterised in that the computer is programmable to define identity signals
15 for specific responder modules.

36. A control system as claimed in any of claims **26** to **35** characterised in that the computer is programmable to define the response of a specific responder module.

37. A control system as claimed in any of claims **13** to **36**
20 characterised in that the system comprise a plurality of said controller

modules.

38. A control system as claimed in claim **37** characterised in that each said controller module is operatively associated with all said sensor modules.

5 **39.** A control system as claimed in claim **38** characterised in that each said controller module is operatively associated with a set of said sensor modules.

10 **40.** A control system as claimed in any of claims **13** to **39** characterised in that the system includes an interface for operative connection to a building management system.

15 **41.** A control system as claimed in any of claims **13** to **40** characterised in that the system is configured and arranged to operate as a building management system in which that all communication among the sensor modules, the responder modules and the or each controller module is wireless.

20 **42.** A building management system comprising a plurality of sensor modules operative at a plurality of sensor locations to sense one or more variables, each sensor module in use transmitting from its location radio control signals related to its sensed variable, and a plurality of responder modules operative at a plurality of responder locations to control apparatus, each responder module in use receiving radio control signals related to the variables sensed by the sensor modules and controlling said apparatus

automatically in response thereto, characterised in that the sensor modules and responder modules are mutually similar in including a common radio transceiver and signal processor and mutually different in including specific functional variations.

5 **43.** A building management system as claimed in claim **42** characterised in that at least one sensor module has a specific functional variation comprising a light sensitive resistor operatively connected to the processor arranged to sense ambient light level.

10 **44.** A building management system as claimed in claim **42** or claim **43** characterised in that at least one sensor module has a functional variation comprising a motion detector operatively connected to the processor and arranged to sense the presence or absence of persons.

15 **45.** A building management system as claimed in any of claims **42** to **44** characterised in that at least one responder module has a functional variation comprising a relay and drive circuit operative to switch said apparatus on and off alternatively.

20 **46.** A building management system as claimed in any of claims **42** to **45** characterised in that at least one responder module has a functional variation comprising an operational amplifier circuit providing a DSI interface to a dimmable ballast for adjusting fluorescent lighting.

47. A building management system as claimed in any of claims **42** to **46** characterised in that at least one responder module has a functional

variation comprising a relay and a battery with a current limiting circuit arranged to operate emergency lighting in the event of mains power failure.

5 **48.** A building management system as claimed in any of claims **42** to **47** characterised in that at least one responder module has a functional variation comprising retransmission of control signals it receives, whereby said responder module acts as a repeater in the system.

49. A building management system as claimed in claim **48** characterised in that said responder module includes means whereby retransmission is selectively enabled and disabled alternatively.

10 **50.** A building management system as claimed in any of claims **42** to **49** characterised in that the system includes a controller module operative to receive radio control signals from the sensor modules and to transmit radio control signals to the responder modules.

15 **51.** A building management system as claimed in claim **50** characterised in that the controller module is similar to the sensor modules and responder modules in including a common radio transceiver and signal processor and differs from the sensor modules and responder modules in including specific functional variations.

20 **52.** A building management system as claimed in claim **51** characterised in that the controller module has a functional variation comprising a first manual control operable to adjust output from controlled apparatus.

53. A building management system as claimed in claim **51** or claim **52** characterised in that the controller module has a functional variation comprising a second manual control operable to override the automatic response of one or more said responder modules.

5 **54.** A building management system as claimed in any of claims **51** to **54** characterised in that the controller module has a functional variation comprising a display panel operative in use to show the operative status of sensor modules and/or responder modules.

10 **55.** A building management system as claimed in any of claims **51** to **54** characterised in that the controller module has a functional variation comprising a relay operatively connected to the processor and a battery, the relay being arranged in a mains power supply line to detect failure of mains power and connect said battery.

15 **56.** A building management system as claimed in any of claims **51** to **55** characterised in that the system comprises more than one controller module.

57. A building management system as claimed in claim **56** characterised in that one said controller module is portable.

20 **58.** A method of controlling facilities of a building in response to changes of a plurality of variables, which method comprises sensing said changes at a plurality of sensor locations, transmitting from the sensor locations control signals representing said changes to a plurality of facility

locations for control of facilities thereat and transmitting management signals between the sensor locations and the facility locations, characterised in that all said signals are wireless.

5 **59.** A method of controlling facilities of a building as claimed in claim **58** characterised in that at least some of said variables are of different kinds.

60. A method of controlling facilities of a building as claimed in claim **58** or claim **59** characterised in that the control signals comprise signals representing occupancy of the building, ambient temperature,
10 ambient light level, power supply and/or time.

61. A method of controlling facilities of a building as claimed in any of claim **58** to **60** characterised in that the management signals comprise signals representing the locations, status of facilities at the locations, requests for said status, facility correction and/or status confirmation.

15 **62.** A method of controlling facilities of a building as claimed in any of claims **58** to **61** characterised in that at least some of said signals are transmitted by way of a central location.

63. A method of controlling facilities of a building as claimed in claim **62** characterised in that said signals are monitored at the central
20 location.

64. A method of controlling facilities of a building as claimed in

claim **62** or claim **63** characterised in that additional signals are transmitted from the central location.

5 **65.** A method of controlling facilities of a building as claimed in claim **64** characterised in that the additional signals comprise control signals and/or management signals.

66. A method of controlling facilities of a building as claimed in claim **64** or claim **65** characterised in that the additional signals comprise signals operative to alter said sensing and/or the control of facilities.

10 **67.** A method of controlling facilities of a building as claimed in any of claims **58** to **66** characterised in that signals are received and then subjected to a cyclical redundancy check.

68. A control system for controlling apparatus remotely in response to changes of a variable substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

15 **69.** A building management system substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

70. A method of controlling facilities of a building substantially as hereinbefore described with reference to and as shown in the accompanying drawings.